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10/500,934	07/08/2004	Hisao Morooka	120312	1500
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EXAMINER				
TUMMINELLI, ALEXANDER S				
ART UNIT		PAPER NUMBER		
4145				
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Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary

Application No.

10/500,934

Applicant(s)

MOROOKA ET AL.

Examiner

ALEXANDER S. TUMMINELLI

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --
Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☐ Responsive to communication(s) filed on ____.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-13 is/are pending in the application.
- 4a) Of the above claim(s) ____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) ____ is/are allowed.
- 6) ☒ Claim(s) 1-13 is/are rejected.
- 7) ☐ Claim(s) ____ is/are objected to.
- 8) ☐ Claim(s) ____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 2004/07/08 is/are: a) ☐ accepted or b) ☒ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☒ All b) ☐ Some * c) ☐ None of:
- ☐ Certified copies of the priority documents have been received.
 - ☐ Certified copies of the priority documents have been received in Application No. ____.
 - ☒ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-946)
- 3) ☒ Information Disclosure Statement(s) (PTO/SF/08)
Paper No(s)/Mail Date 20050411, 20071203
- 4) ☐ Interview Summary (PTO-413)
Paper No(s)/Mail Date ____
- 5) ☐ Notice of Informal Patent Application
- 6) ☐ Other: ____

DETAILED ACTION

Drawings

1. Figures 1-3 should be designated by a legend such as --Prior Art-- because only that which is old is illustrated. See MPEP § 608.02(g). Corrected drawings in compliance with 37 CFR 1.121(d) are required in reply to the Office action to avoid abandonment of the application. The replacement sheet(s) should be labeled "Replacement Sheet" in the page header (as per 37 CFR 1.84(c)) so as not to obstruct any portion of the drawing figures. If the changes are not accepted by the examiner, the applicant will be notified and informed of any required corrective action in the next Office action. The objection to the drawings will not be held in abeyance.

Claim Rejections - 35 USC § 103

2. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

3. The factual inquiries set forth in *Graham v. John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.
4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

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4. This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

5. Claims 1, 2, and 10-12 are rejected under 35 U.S.C. 103(a) as being unpatentable over Takaharu (JP 2001-244488) in view of Sano et al (US 2001/0037824 A1).

Regarding claim 1, Takaharu teaches a photovoltaic element comprising:

- a substrate (Drawing 1/101-1 and 101-2),
- a first transparent electrode layer formed on said substrate (Drawing 1/101-3),
- an electric power generating layer formed on said first transparent electrode layer, said electric power generating layer being constituted by a first conduction type semiconductor film (Drawing 2/102-1), an intrinsic semiconductor film (Drawing 2/102-2) and a second conduction type semiconductor film different in conduction type from said first conduction type semiconductor film (Drawing 2/102-3),

- an second transparent electrode layer formed on said electric power generating layer (Drawing 1/103).

However, Takaharu does not teach the intermediate layer made of a given material except oxide between said first transparent electrode layer and said electric power generating layer.

Sano et al discloses a photovoltaic element comprising:

- a substrate, (Fig. 2/11)
- a first transparent electrode layer formed on said substrate, (Fig. 2/12-1)
- an electric power generating layer formed on said first transparent electrode layer, said electric power generating layer being constituted by a first conduction type semiconductor film (Fig. 2/13), an intrinsic semiconductor film (Fig. 2/14) and a second conduction type semiconductor film different in conduction type from said first conduction type semiconductor film (Fig. 2/15),
- an intermediate layer made of a given material except oxide between said first transparent electrode layer and said electric power generating layer (Fig. 2/17).

Sano et al also teaches that the object of the invention is to repress the degradation of the open circuit voltage in the photovoltaic element (paragraph [0012]). Sano et al also teaches that this repression of the degradation of the open circuit voltage is accomplished by inserting an intermediate layer between the transparent conductive film and the semiconductor layers (paragraph [0023]).

It would be obvious to one of ordinary skill in the pertinent art at the time of the invention to add the intermediate layer of Sano et al to the device disclosed in Takaharu for the purpose of repressing the degradation of the open circuit voltage in the photovoltaic element. It is known in the art that the degradation of the open circuit voltage can reduce the power output of the device, thereby reducing its efficiency.

Regarding claim 2, modified Takaharu discloses all of the claim limitations as set forth above.

Sano et al also teaches a photovoltaic element, wherein a thickness of said intermediate layer is set within 0.5-20nm (paragraph [0042]). Sano et al also teaches that the intermediate layer should not be thinner than 0.5 nm because then the photovoltaic element may not repress the degradation of the open circuit voltage and the intermediate layer should not be thicker than 15 nm, because then the series resistance may be increased, resulting in the reduction of a current in the photovoltaic element (paragraph [0042]).

Therefore, it would be obvious to one of ordinary skill in the pertinent art at the time of the invention to use a range for the thickness of the intermediate layer as set forth in Sano et al, within modified Takaharu for the purpose of achieving a repression of the degradation of the open circuit voltage while not increasing the series resistance of the device, resulting in the reduction of a current in the photovoltaic element.

Regarding claim 10, modified Takaharu discloses all of the claim limitations as set forth above. Additionally, Takaharu discloses a photovoltaic element, wherein said first transparent electrode film is made of a ZnO film (paragraph [0034]).

Regarding claim 11, modified Takaharu discloses all of the claim limitations as set forth above. Additionally, Takaharu discloses a photovoltaic element, wherein said second transparent electrode film is made of an ITO film (paragraph [0061]).

Regarding claim 12, modified Takaharu discloses all of the claim limitations as set forth above. Additionally, Takaharu discloses a photovoltaic element, wherein said electric power generating layer is formed by means of plasma CVD (paragraph [0055]).

Regarding the recitation of a method of making said electric power generating layer, the examiner notes that the determination of patentability is determined by the recited structure of the apparatus and not by a method of making said structure. A claim containing a recitation with respect to the manner in which a claimed apparatus is made does not differentiate the claimed apparatus from a prior art apparatus if the prior art apparatus teaches all the structural limitations of the claim.

6. Claims 3-9 are rejected under 35 U.S.C. 103(a) as being unpatentable over Takaharu (JP 2001-244488) in view of Sano et al (US 2001/0037824 A1) as applied to claims 1 and 2 above, and further in view of Otake (JP 58092281 A).

Regarding claim 3, modified Takaharu discloses all of the claim limitations as set forth above. Additionally, Takaharu discloses a back electrode layer on said second transparent layer (Drawing 1/104) and that the substrate is made of a transparent material (paragraph[0031]), but does not explicitly disclose composition of the intermediate layer.

Otake teaches a photovoltaic element, comprising a back electrode layer (Fig. 2/25), wherein a substrate is made of a given transparent material (abstract, Fig. 2/21)

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and an intermediate layer is made of a metal composed of at least one selected from the group consisting of Fe, Ni, Cr, W, Ti, Ag, Ta and Mo or a silicide composed of at least one selected from the group consisting of Fe, V, Mn, Co, Zr, Nb, Pt, Ni, Cr, W, Ti, Ta and Mo (abstract, Fig. 2/23). Otake also teaches that both Mo or molybdenum silicide can be used as the intermediate layer between an amorphous silicon layer and a transparent conducting film (abstract). Otake also teaches that the reason for using Mo or molybdenum silicide is to prevent diffusion of the element constituting the transparent conducting film into the amorphous silicon (abstract).

It would be obvious to one of ordinary skill in the pertinent art at the time of the invention to combine the use of Mo or molybdenum silicide as the intermediate layer in a photovoltaic device with the photovoltaic device disclosed in modified Takaharu for the purpose of preventing the diffusion of the element constituting the transparent conducting film into the amorphous silicon. Both modified Takaharu and Otake disclose photovoltaic devices with similar structure and composition, but modified Takaharu does not disclose the composition of the intermediate layer. The use of Mo or molybdenum silicide will increase yield rate and performance, therefore making it obvious to use.

Regarding claim 4, modified Takaharu discloses all of the claim limitations as set forth above. Additionally, Takaharu teaches a photovoltaic element, wherein said substrate is made of an organic film (paragraph [0031]). Takaharu teaches that the base (substrate) can be made of polyimide, which is known to be an organic polymer (paragraph[0031]).

Regarding claim 5, modified Takaharu discloses all of the claim limitations as set forth above. Additionally, Takaharu discloses the substrate can be made of a metallic material (paragraph [0031]) and Takaharu teaches that the base (substrate) can be made of stainless steel, which is a metallic material (paragraph [0031]), but does not explicitly disclose composition of the intermediate layer.

Otake teaches a photovoltaic element, wherein an intermediate layer is made of a metal composed of at least one selected from the group consisting of Fe, Mn, Co, Zr, Nb, Pt, Ni, Cr, W, Ti, Ta and Mo or a silicide composed of at least one selected from the group consisting of Fe, V, Mn, Co, Zr, Nb, Pt, Ni, Cr, W, Ti, Ta and Mo (abstract, Fig. 2/23). Otake also teaches that both Mo or molybdenum silicide can be used as the intermediate layer between an amorphous silicon layer and a transparent conducting film (abstract). Otake also teaches that the reason for using Mo or molybdenum silicide is to prevent diffusion of the element constituting the transparent conducting film into the amorphous silicon (abstract).

It would be obvious to one of ordinary skill in the pertinent art at the time of the invention to combine the use of Mo or molybdenum silicide as the intermediate layer in a photovoltaic device with the photovoltaic device disclosed in modified Takaharu for the purpose of preventing the diffusion of the element constituting the transparent conducting film into the amorphous silicon. Both modified Takaharu and Otake disclose photovoltaic devices with similar structure and composition, but modified Takaharu does not disclose the composition of the intermediate layer. The use of Mo or molybdenum silicide will increase yield rate and performance, therefore making it obvious to use.

Regarding claim 6, modified Takaharu discloses all of the claim limitations as set forth above. Additionally, Takaharu discloses a photovoltaic element, wherein said substrate is made of a stainless foil (paragraph [0031]). Takaharu teaches that the base (substrate) can be made of stainless steel, which is a stainless foil (paragraph [0031]).

Regarding claim 7, modified Takaharu discloses all of the claim limitations as set forth above. Additionally, Takaharu discloses the substrate is composed of a first substrate made of a given transparent material and a second substrate made of a given metallic material (paragraphs [0031-0032], Drawing 1/101-1 and 101-2), but does not explicitly disclose composition of the intermediate layer.

Otake teaches a photovoltaic element, wherein a substrate is composed of a given transparent material (abstract, Fig 2/21), and an intermediate layer is made of a metal composed of at least one selected from the group consisting of Fe, V, Mn, Co, Zr, Nb, Pt, Ni, Cr, W, Ti, Ta and Mo or a silicide composed of at least one selected from the group consisting of Fe, V, Mn, Co, Zr, Nb, Pt, Ni, Cr, W, Ti, Ta and Mo (abstract, Fig. 2/23). Otake also teaches that both Mo or molybdenum silicide can be used as the intermediate layer between an amorphous silicon layer and a transparent conducting film (abstract). Otake also teaches that the reason for using Mo or molybdenum silicide is to prevent diffusion of the element constituting the transparent conducting film into the amorphous silicon (abstract).

It would be obvious to one of ordinary skill in the pertinent art at the time of the invention to combine the use of Mo or molybdenum silicide as the intermediate layer in

a photovoltaic device with the photovoltaic device disclosed in modified Takaharu for the purpose of preventing the diffusion of the element constituting the transparent conducting film into the amorphous silicon. Both modified Takaharu and Otake disclose photovoltaic devices with similar structure and composition, but modified Takaharu does not disclose the composition of the intermediate layer. The use of Mo or molybdenum silicide will increase yield rate and performance, therefore making it obvious to use.

Regarding claim 8, modified Takaharu discloses all of the claim limitations as set forth above. Additionally, Takaharu teaches a photovoltaic element, wherein said first substrate is made of an organic film (paragraph [0031]). Takaharu teaches that the base (first substrate) can be made of polyimide, which is known to be an organic polymer (paragraph[0031]).

Regarding claim 9, modified Takaharu discloses all of the claim limitations as set forth above. Additionally, Takaharu teaches a photovoltaic element, wherein said second substrate is made of a stainless foil (paragraph [0032]). Takaharu teaches that the metal layer (second substrate) can be made of aluminum, Cu, Ag, Au, CuMg, AlSi, or other metallic layer (paragraph [0032]) and it is known in the art that aluminum is resistant to corrosion (stainless).

7. Claim 13 is rejected under 35 U.S.C. 103(a) as being unpatentable over Takaharu (JP 2001-244488) in view of Sano et al (US 2001/0037824 A1) as applied to claims 1, 2, and 10-12 above, and further in view of Kuwano et al (US 4281208).

Regarding claim 13, modified Takaharu discloses all of the claim limitations as set forth above, but does not explicitly disclose the material from which the power generating layer is made.

Kuwano et al teaches a photovoltaic element, wherein said electric power generating layer is made of amorphous silicon (abstract). Kuwano et al also teaches that the device has a light transmissive insulating substrate, on which a plurality of isolated transparent electrodes are formed (abstract). An amorphous silicon layer of a PIN structure (power generating layer) is formed on the substrate continuously and in common to the respective transparent electrodes (abstract). It is also well known in the art that amorphous silicon is widely used in photovoltaic elements because of its capability of being deposited in very thin layers, allowing them to be processed with ease.

It would be obvious to one of ordinary skill in the pertinent art at the time of the invention to combine the amorphous silicon PIN structure of Kuwano et al with the device disclosed in modified Takaharu for the purpose of processing the photovoltaic device in an easier fashion. Kuwano et al discloses a device similar in structure to modified Takaharu and also discloses that the PIN layer (power generating layer) is to be made of amorphous silicon. Since it is well known in the art that amorphous silicon is easily processed, it would be obvious to one of ordinary skill in the pertinent art to apply it to modified Takaharu.

Conclusion

8. Any inquiry concerning this communication or earlier communications from the examiner should be directed to ALEXANDER S. TUMMINELLI whose telephone number is (571)270-3878. The examiner can normally be reached on Monday-Thursday, 7:30am-5pm EST, Alt. Friday.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Basia Ridley can be reached on (571)272-1453. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

AST

/Basia Ridley/
Supervisory Patent Examiner, Art Unit 4145